Anywire Corporation

AnyWire DB A20 Series
OMRON CS1 PLC Interface
AFCS01-D2
User's Manual

Ver. 1.0 November 21, 2008

High speed transmission wiring saving system by full-duplex transmission method

AnyWire DB A20 series

PMA-06502A

Cautionary Instructions

Cautions about this manual

1. Please deliver this manual to end users.
2. Read this manual thoroughly to understand the contents before operating this product.
3. This manual explains the details of functions equipped with this product, and does not guarantee that the product will match a customer's particular purpose.
4. Any reproduction or copying of this manual in whole or in part is expressly prohibited without permission.
5. Information in this manual may be subject to change without notice in the future.

Warning displays

A "WARNING" indicates a potentially hazardous situation which, if not handled properly, could result in personal serious injury or death.

A "CAUTION" indicates a potentially hazardous situation which, if not handled properly, could result in personal injury or property damage.

Safety precautions

- The AnyWire system does not include any control functions to ensure safety.
- In any of the following cases, pay special attention to use with appropriate allowance for ratings and functions and implement safety measures such as a fail-safe design and consult us for:

(1) Applications which require a high degree of safety

・Applications predicted to have a great impact on human life or property

・Medical equipment, safety equipment, etc.

(2) When used in systems which require a higher degree of reliability

・Use in vehicle control, combustion control equipment, etc.

- Make sure to turn off the system power before installation or replacement work.
- Use the AnyWire system within the range of specifications and conditions defined in this manual.

CAUTION

◆ Do not turn on the 24V power before completing wiring and connection of the entire AnyWire system.

◆ Use a regulated, 24V DC power supply for AnyWire system equipment.

◆ Although the AnyWire system has high noise resistance, keep transmission cables and I/O cables away from high-voltage and power cables.

◆ Be careful to prevent any waste metal from entering inside of units or connector parts, especially during wiring.

◆ Miswiring may damage equipment. Pay attention to the cable length and layout in order to prevent connectors and cables from being removed.

◆ Do not solder a stranded wire to be connected to the terminal block; otherwise a contact failure may occur.

◆ If the wiring length of the power cable is long, voltage drops will occur and may cause shortages of the power voltage of remote slave units. In that case, connect local power supply units to ensure the specified voltage.

◆ Install the product by avoiding the following places:

- Where exposed to direct sunlight or the ambient operating temperature exceeds the range of 0°C to 55°C
- Where the operating relative humidity exceeds the range of 10% to 90% or condensation occurs due to rapid temperature changes
- Where there is corrosive or inflammable gas
- Where subjected to direct vibration or shock

◆ Tighten terminal screws securely to avoid malfunctions, etc.

◆ When storing the product, avoid high temperature and humidity. (Ambient storage temperature: -20°C to 75°C)

◆ Incorporate the emergency stop circuit or interlock circuit for safety in an external circuit other than the AnyWire system.

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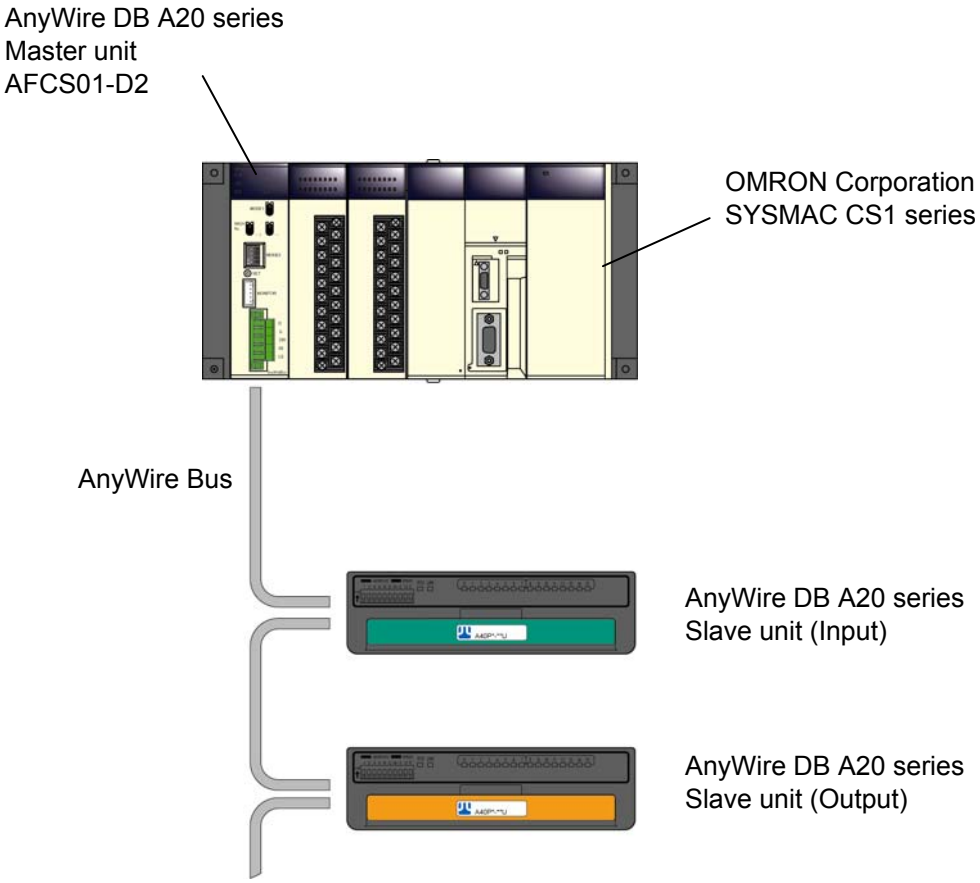
1 Overview

This unit is a master interface for the AnyWire DB A20 series that can be mounted on the OMRON CS1 series PLC.
The AnyWire system is a high speed, highly reliable wiring saving system by unique transmission method.

Note) AnyWire is a registered trademark of Anywire Corporation.

The AnyWire DB A20 series is a full-duplex transmission system which supports, in particular, high speed or long distance, and can input and output at a maximum 512 points respectively, and transmit by transmission distances of 50m, 200m, 1km and 3km.
Disconnection can be detected even if branch wiring is carried out.



2 Specifications

2.1. General specifications

Operating ambient temperature	0 ~ +55°C
Operating ambient humidity Storage ambient humidity	10 ~ 90% RH (No condensation)
Storage ambient temperature	-20°C ~ +75°C
Atmosphere	No corrosive or inflammable gas
Vibration proof	JIS C 0040 compliant
Noise proof	1200Vp-p (Pulse width 1μs)

2.2. Performance specifications

Transmission clock	2kHz	7.8kHz	31.3kHz	125kHz
Maximum transmission distance	3km	1km	200m	50m
Transmission method	Full-duplex cyclic method			
Connection mode	Bus type (Multi drop method, T-branch method, tree branch method)			
Transmission protocol	Dedicated protocol (AnyWireBus protocol)			
Error control	Double collation system			
Number of connecting IO points	Max. 1024 points (Input 512 points/Output 512 points)			
Number of connection nodes	Max. 128 nodes (Fine =1) However, **up to 2km: 64 units, up to 3km: 32 units**			
RAS functions	Transmission line disconnection position detecting function, transmission line short-circuit detecting function, transmission power drop detecting function			
Connection cable	Multi-purpose 2 line cable/4 line cable (VCTF 0.75 ~ 1.25mm^2) Dedicated flat cable (0.75mm^2) Multi-purpose electric wire (0.75~1.25mm^2) (If transmission distance exceeds 1 km, VCTF 1.25mm^2 or more)			
Power supply	Circuit: (Supply from CS1 side) Voltage +5[V]±5% Current 0.4[A] Transmission line: Voltage 24V DC +15 ~ -10% (21.6~27.6V DC) ripple 0.5Vp-p or less Current 0.2[A] (Load current is not included when 128 terminal units are connected)			

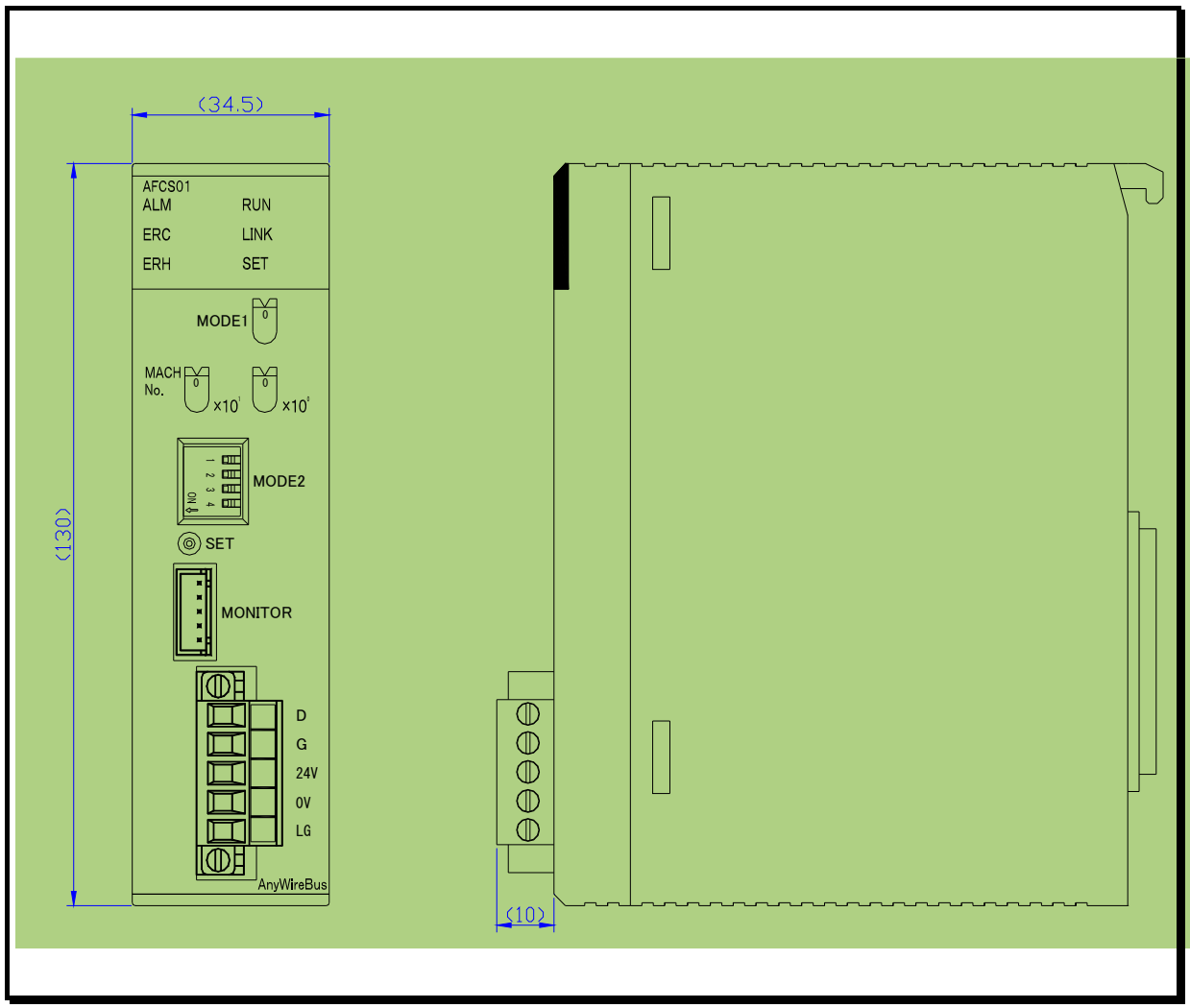
■ Maximum cycle time

(Unit: ms)

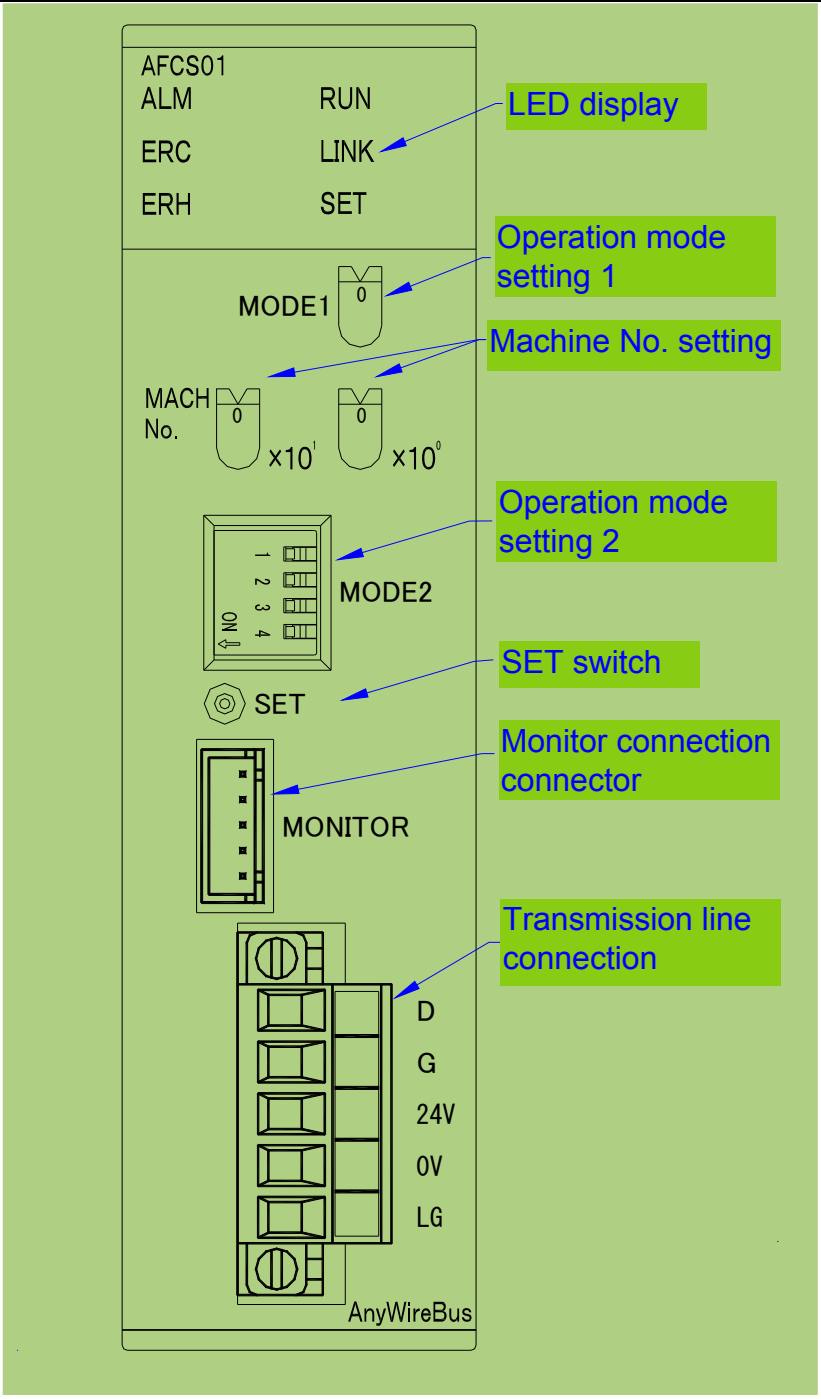
Operation mode setting / Transmission clock	1 512points (256 points×2)	0 1024 points (512 points×2)
2kHz	138.4 max.	265.4 max.
7.8kHz	35.8 max.	68.5 max.
31.3kHz	9.0 max.	17.2 max.
125kHz	2.3 max.	4.3 max.

Caution: ① Transmission cycle time is a value between one cycle time and two cycle time.
② In order to ensure that input signal responds, issue input signal longer than two cycle time.

2.3. Dimensional outline drawing



2.4. Name of each part



2.5. Unit assembling

After connecting the units, slide the upper and lower sliders until a clicking sound is heard to securely lock.

Note that the functions may not be fulfilled unless locked.

Make sure to install the end cover attached to the CPU unit onto the rightmost unit. Unless the end cover is installed, the CS series will not operate properly.

3 Operation Mode

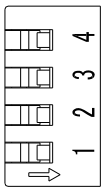
3.1. Machine No. setting

Set the machine No. of this unit by the “Machine No. setting switch” (rotary dip switch).
Since this unit occupies 4 machines by one unit, set the number within the range from “0” to “92.”
For example, “04” to “07” are occupied when “04” is set. Do not set this number for other unit(s) within this range.

3.2. Specification selection (Operation Mode setting 2 switch)

Select transmission distance etc., with the operation mode setting 2 switch (quad dip switch).

SW-1, 2 Sets transmission distance by combination of ON/OFF with 1 and 2.
SW-3 Setting switch for Bit mode operation. Use this in OFF.
SW-4 System reserve (Use this in OFF.)



ON on right side

* All the default switch positions are at “OFF.”

Specification	Operation mode 2 switch	
	1	2
2kHz 3km	OFF	OFF
7.8kHz 1km	OFF	ON
31.3kHz 200m	ON	OFF
125kHz 50m	ON	ON

Operation mode 2 switch	Operation mode	Specification
3		
OFF	Bit mode	Carry out double collation for data every bit (1 point). Use Bit type for slave.
Turn OFF when using.		

3.3. Input and output point number setting (Operation mode setting 1 switch)

Select input and output point number with the operation mode setting 1 switch (rotary DIP switch).

Operation mode		Operation mode 1 switch
Input	Output	
512 points	512 points	0
256 points	256 points	1
512 points	512 points	2~F

CAUTION

- Make sure to turn off the power to set the DIP switch.
- Make sure to set the DIP switch according to the transmission specification to be used.
- Ensure that the DIP switch meets the transmission specification of the slave unit connected to this unit. Unless it meets the specification, transmission cannot be properly made, or a malfunction may result.

4 Memory Map

Offset address	Description
0~31	Output (32ch)
32~63	System reserve (32ch should not be used)
64	Error reset output (1 word)
65~67	System reserve (3ch should not be used)
200~231	Input (32ch)
232~263	System reserve (32ch should not be used)
264	Error flag input (1ch)
265	Address response error slave unit number input (1ch)
266~281	Error address (16ch)
282~283	System reserve (2ch should not be used)

(System reserve area should not be used.)

Data is mapped to the area after channel DM20000 is determined by the machine No.
The start channel No. is obtained by:

Start channel No.= 20000 + Offset address + Machine No. × 100

<Example> When the machine No. is “4”:

The start channel No. for output is from DM20400, by: 20000 + 0 + 4 × 100.
The start channel No. for input is from DM20600, by: 20000 + 200 + 4 × 100.
Correspondence between word address No. and data memory on AnyWireBus is as follows.

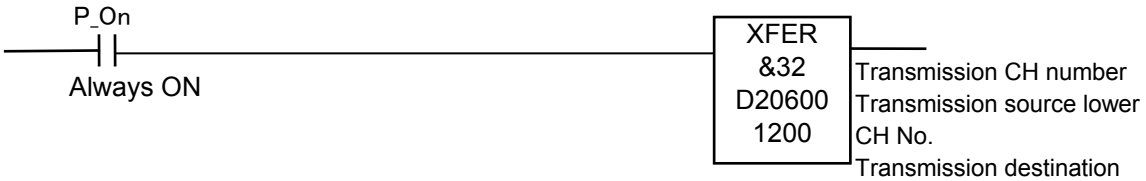
	Offset address	① ch No.	Bit No. 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output	0	DM20400	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	DM20401	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	¦	¦	¦															
	31	DM20431	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496
Input	200	DM20600	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	201	DM20601	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	¦	¦	¦															
	231	DM20631	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496

<Note> The ① column in the table shows an example when the machine No. is set to “4.”
Numbers from 1 to 511 in the table represent the address No. on the AnyWireBus.

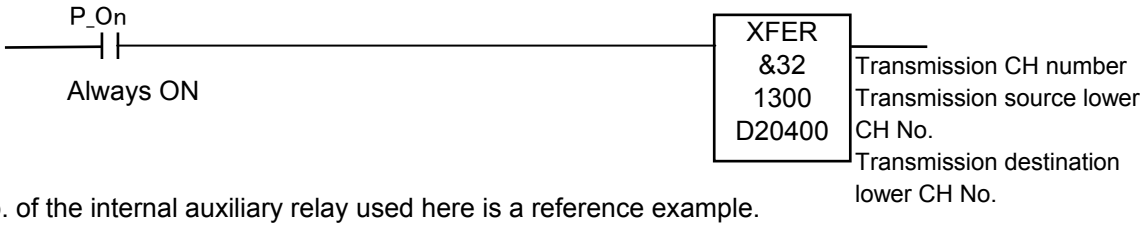
Memory Map

Because the DM area cannot be handled by bit, it can be handled by relocating it to internal auxiliary relay. Use block transmission instruction XFER for relocation.

Reference program for relocating input data



Reference program for relocating output data



No. of the internal auxiliary relay used here is a reference example.
Specify appropriate No. which is not used in other areas of the program.
In this example, input is mapped to 1200.00 through 1231.15, and output is mapped to 1300.00 through 1331.15.

Note

Other than the above, this unit occupies an area of 40 channels after channel 2000 is determined by the machine No.
Do not use this area.
The start channel No. is obtained by:

Start channel No. = 2000 + Offset address + Machine No. × 10

<Example> When the machine No. is “4”:

The start channel No. is from 2040, by: 2000 + 0 + 4 × 10.
Channels 2040 through 2079 are occupied by this machine.

5 Monitoring function

Overview

The slave units of the AnyWire system have their own addresses, and a slave unit which has an address which was sent from this machine returns responses to the address, then detects for disconnection and checks for existence of a slave unit.

This machine stores an address of the slave unit which is connected at that time by the automatic address recognition operation (described later) into EEPROM. This information is stored even if the power is turned off.

Then registered addresses are sequentially sent out, and if there is no response to them, disconnection is displayed by the “ALM” LED, and an error flag is returned. In addition, addresses of the slave units having errors can be known.

5.1. Automatic address recognition

Storing addresses of the connected slave units into EEPROM of this machine is called “Automatic address recognition.”

Procedure

1 Check that all of the slave units operate normally.

2 Press the “SET” switch until the “SET” LED (Green) lights up.

3 If the “SET” LED lights up for a while and then turns off, storage of an address has been completed.

〔Timing of automatic address recognition operation〕

Perform the automatic address recognition operation at the following times.

・When all slave units are connected to the master unit and operation is started for the first time in a state that the address and transmission speed are normal.

・When some slave units are added.

・When some slave units are removed.

・When the address of the connected slave unit is changed after automatic address recognition.

〔Caution〕

If any disconnection error occurs during operation, do not perform the automatic address recognition operation. Disconnection information will be lost.

The automatic address recognition operation cannot be performed for approximately 5 seconds at the time of any error in AnyWireBus such as short-circuit, after power is turned on, or after reset.

5.2. Monitoring operation

Addresses registered in this machine are sequentially sent out, and if there is no response to them, disconnection is displayed by the “ALM” LED.

Bit 3 of the error flag is set to “1”.

This error information is retained until the power is turned off or the error is reset. (Refer to the item of error status.)

6 Error status

The status of a transmission line can be known by the error status of this machine.
The error status consists of a number of addresses from which an error flag and disconnection are detected and the 16 error addresses. If any error by disconnection occurs, the applicable slave unit can be known from the information of the number of addresses and information on an error address.
If there are 16 or more error addresses, 16 addresses are displayed sequentially in the order of the most recent number.

Correspondence between error information and data memory is as follows.

Offset address	② ch No.	Description
264	DM20664	Error flag
265	DM20665	Number of error address
266	DM20666	Error address 1
267	DM20667	Error address 2
268	DM20668	Error address 3
¦	¦	¦
280	DM20680	Error address 15
281	DM20681	Error address 16

<Note> The ② column in the table shows an example when the machine No. is set to “4.”

6.1. Error flag

An error flag can be read by setting the offset address to 264.
The number of error addresses can be read by setting the offset address to 265.
This status can also be displayed by the “ALM” LED.
The associated bit becomes “1” if any error occurs.
Bit 3 is retained until the power is turned off, or an error is reset (described later).
Bit 0, 1 and 2 become “0” when an error status is cancelled. They are not retained.

Bit 0	Short-circuit between D and G
Bit 1	Short-circuit between D and P
Bit 2	24V is not supplied, or voltage is low.
Bit 3	Disconnected. Or slave unit failed, or power is not supplied.
Bit 4~15	Reserved

6.1.1. How to reset error status

Rewrite “0” to “1”, and then to “0” in the data memory of the offset address 64.
If an error such as disconnection is eliminated, the disconnection flag is reset to “0” and the number of error addresses is also reset to “0.”
Unless an error condition is eliminated, the number of error flags and error address are set, and the error address is set again.
An error is also cleared by turning on power again.

Offset address	② Ch No.	Description
64	DM20464	Error reset output

<Note> The ② column in the table shows an example when the machine No. is set to “4.”

6.2. Error address

When disconnection or any error in the slave unit occurs, up to 16 error addresses are written into the offset addresses 266 to 281. (See 4 Memory map.)
Values written are classified according to the following table.

Hexadecimal display address	Description
000~1FF	Address of output slave
200~3FF	Address of input slave

The lower 2 digits represent the address set for the slave unit.
The uppermost digit represents the type of slave unit.

This value is retained until the error is reset or the power is turned OFF.

7 LED Display

LED indicating the status of this unit

LED	Name	Color	Indication	
RUN	Operating	Green	Lit	This unit is operating.
			Unlit	This unit is in a stopped state.
ERC	Unit error	Red	Lit	This unit has an error.
			Unlit	This unit is normal.
ERH	CPU unit error	Red	Lit	There is an error caused by the CPU unit.
			Unlit	The CPU unit is normal.

Main causes of ERC LED and ERH LED lighting

Causes of ERC LED lighting	This unit is not recognized as a high-performance I/O unit.
	Hardware check error
Causes of ERH LED lighting	The machine No. is not set within the range of 00 to 92.
	Double setting of a machine No.
	No units registered in the I/O table.
	I/O bus error
	CPU watchdog timer error

LED indicating AnyWireBus status

LED	Name	Color	Indication	
LINK	Transmission display	Green	Flashing	This unit is operating.
			Unlit	This unit has an error.
SET	Display on address recognition operation	Green	Lit	In automatic address recognition operation.
			Unlit	In normal transmission.
			Flashing	Writing in EEPROM
ALM	Alarm display	Red	Lit	Disconnection of AnyWireBus D, G is detected.
			Slow flashing*1	Short-circuit between D and G, or short-circuit between D and 24V is detected.
			Quick flashing*2	24V is not supplied, or low voltage status is detected.
			Unlit	On normal transmission.

*1: “Slow flashing” is flashing of approximately 1 second period.
*2: “Quick flashing” is flashing of approximately 0.2 seconds period.

In profile rewrite mode, ERC and ERH are displayed as follows:

LED	Name	Color	Indication	
ERC	Unit error	Red	Lit	Normal termination
			Flashing	Abnormal termination
ERH	CPU unit error	Red	Lit	Profile rewrite mode display

8 Connection

AnyWireBus connecting terminal of this machine is provided with quick detachable connector terminals.
Model: MSTB2.5/5-STF-5.08 (manufactured by PHOENIX CONTACT)
Connectable cable: 0.2 ~ 2.5mm^2 (AWG24 ~ 12)
Tightening torque: 0.5 ~ 0.6N·m

D	Transmission cable
G	Transmission cable
24V	Connect a regulated 24V DC power supply. Select a power supply with the current capacity necessary for load and slave unit and +0.2A or more.
0V	
LG	Connected to neutral point of noise filter. Ground when there is a malfunction due to 24V based power noise. In this case, ground to the function grounding terminal of PLC at one point.

Connect D and G with D and G of the slave unit respectively.
(Refer to the instruction manual of each unit.)

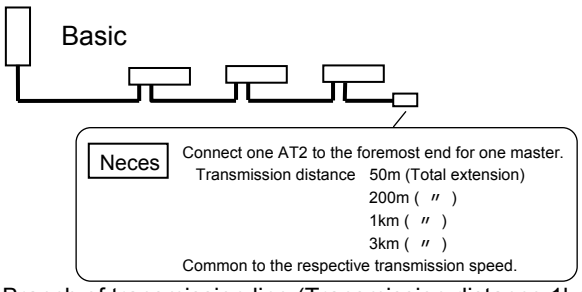
CAUTION

MONITOR connector
Connector for connecting maintenance monitor.
Status of I/O can be known by monitoring the word area with the DB monitor.

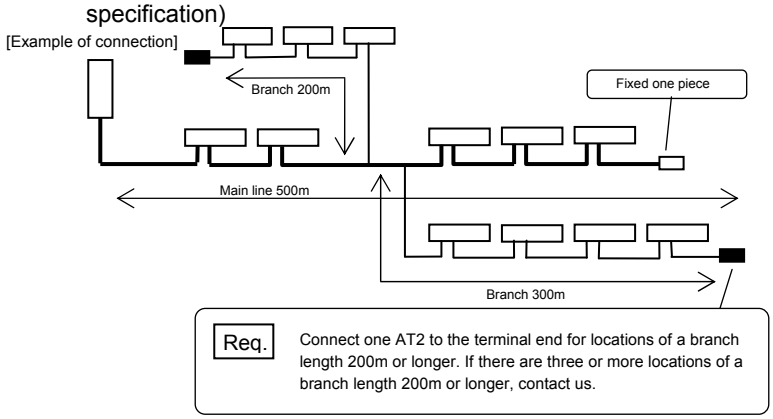
8.1. Terminator

In order to ensure more stable transmission quality, connect a terminator (**AT2**) to the transmission line end.

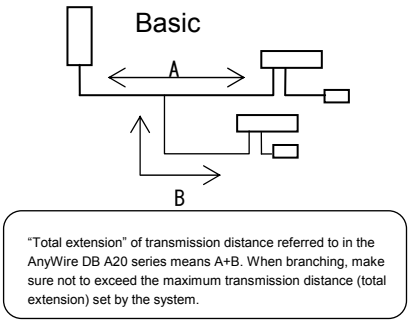
■Connection of terminator


Basic
Neces
Connect one AT2 to the foremost end for one master.
Transmission distance 50m (Total extension)
200m (〃)
1km (〃)
3km (〃)
Common to the respective transmission speed.

■Branch of transmission line (Transmission distance 1km specification)

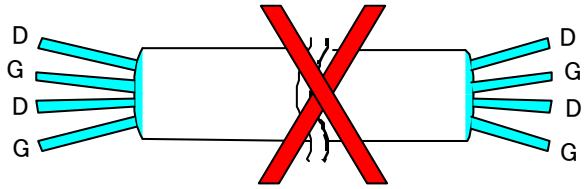

[Example of connection]
Branch 200m
Fixed one piece
Main line 500m
Branch 300m
Req.
Connect one AT2 to the terminal end for locations of a branch length 200m or longer. If there are three or more locations of a branch length 200m or longer, contact us.

■Total extension


Basic
A
B
"Total extension" of transmission distance referred to in the AnyWire DB A20 series means A+B. When branching, make sure not to exceed the maximum transmission distance (total extension) set by the system.

CAUTION

- Do not send some transmission lines (D, G) in a multicore cable all together.
  If sent all together, the equipment will malfunction due to crosstalk.

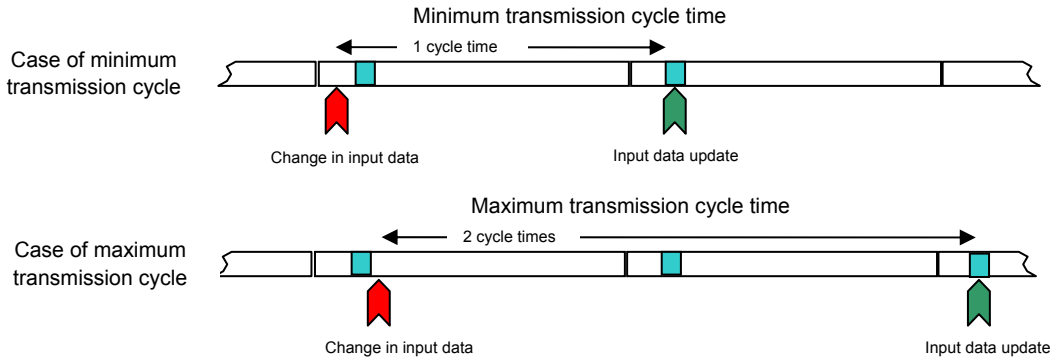


- The transmission line shall be 0.75 to 1.25mm^2 thick.
- The lower limit of the power voltage is down to 21.6V, however, the voltage shall not be below 24V in the master.
- Watch out for voltage drop by cable. Voltage drop will cause the equipment to malfunction.
  If the voltage drops significantly, supply power on the terminal side. (local power supply)
- Do not solder wires connected to the connector terminal. The wire may loosen, resulting in a contact failure.

9 Transmission Required Time

9.1. In the case of input

Because the master side does not update data (double collation) unless the same data consecutively continues two times, the transmission cycle time requires transmission time of a minimum one cycle time and maximum two cycle time. Signals of two cycle times or less may not be captured depending on the timing. Therefore, in order to ensure a response, provide an input signal of two cycle times or longer.



9.2. In the case of output

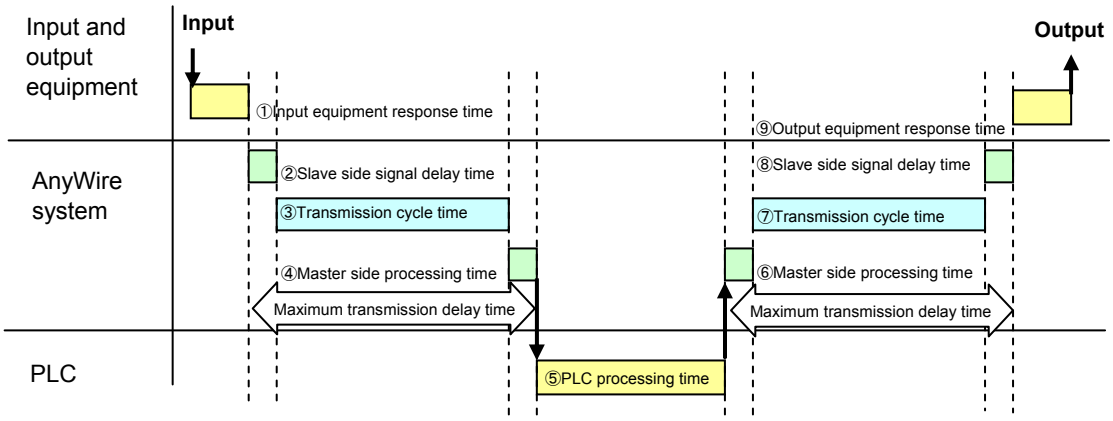
Because the slave unit side performs double collation, it requires transmission time of a minimum one cycle time and maximum two cycle times similar to the case of input.

Terminology

Transmission cycle time: Repeated transmission time of actual data transmitted

Maximum transmission delay time: Processing time on master side+Transmission cycle time+Signal delay time on slave side

Response delay time is as shown in the following diagram.



10 Troubleshooting

Check the following at the start.

(1) The “RDY” lamps for all units of the equipment shall light up.
(2) The “LINK” lamps for all units of the equipment shall flash.
(3) The power voltages for all units of the equipment shall be in a range from 21.6 to 27.6V.
(4) Wiring and connection shall be secured.
(5) Address setting shall be correct, and not be duplicated.

Checklist by symptom

Symptom	Check Item
Data cannot be input and output	**AFCS01-D2 side** MODE switch is correctly set. I/O configuration set with the MODE switch is consistent with I/O No. specified by the software. **Slave unit side** Power is supplied to the slave unit. Address of the slave unit is correctly set. Slave unit of the same specification as that of AFCS01-D2 (such as transmission clock and number of input and output) is used.
ALM LED (Red) lights up	D, G lines are not disconnected. Address automatic recognition operation is correctly performed. Screws on the terminal blocks are not loosened.
ALM LED (Red) slowly flashes	D, G lines are not short-circuited. D does not contact 24V
ALM LED (Red) quickly flashes	Voltage of 24V DC power supplied to AFCS01-D2 is within the allowable range.
ERC LED lights up	Securely connected to the adjacent unit.
ERH LED lights up	Setting of machine No. is in a range from 0 to 92. Machine No. the same as that of the other unit is not set. I/O table is set.
ERR/ALM LED of CPU lights up	The end cover attached to the CPU is installed to the rightmost unit.

11 History of Changes

Version	Date	Change Description
1.0	November 21, 2008	Formal version released

Anywire Corporation

URL http://www.anywire.jp

- **Headquarters**
  1 Babazusho, Nagaokakyo-shi, Kyoto 617-8550 JAPAN
  TEL: (+81) 75-956-1611 (main) FAX: (+81) 75-956-1613
- **West Japan Office**
  1 Babazusho, Nagaokakyo-shi, Kyoto 617-8550 JAPAN
  TEL: (+81) 75-956-4911 FAX: (+81) 75-956-1613
- **East Japan Office**
  6F, Shinkoei Bldg., 47, Kandakonya-cho, Chiyoda-ku, Tokyo 101-0035 JAPAN
  TEL: (+81) 3-5209-5711 FAX: (+81) 3-5209-5713
- **Chubu Office**
  5-1-14, Yadaminami, Higashi-ku, Nagoya-shi, Aichi 461-0048 JAPAN
  TEL: (+81) 52-723-4611 FAX: (+81) 52-723-4683
- **Kyushu Office**
  7F, No. 6 Myojo Bldg., 1-15-2 Tenjin, Chuo-ku, Fukuoka-shi, Fukuoka 810-0001 JAPAN
  TEL: (+81) 92-724-3711 FAX: (+81) 92-724-3713